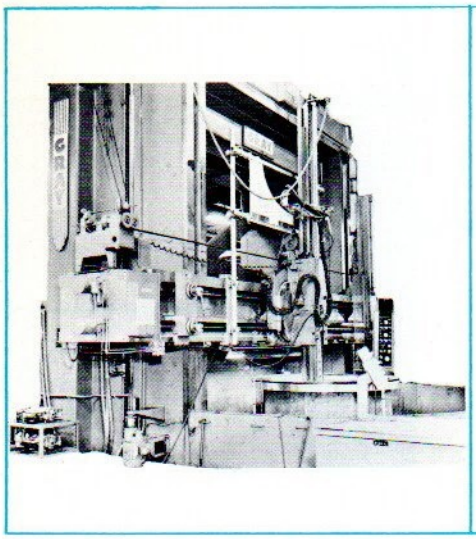
SCAN-O-MATIC®

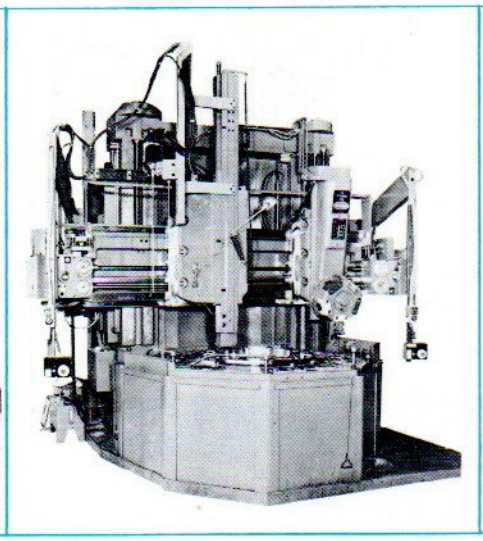
HYDRAULIC TRACER SYSTEMS

FOR VERTICAL TURRET LATHES & BORING MILLS

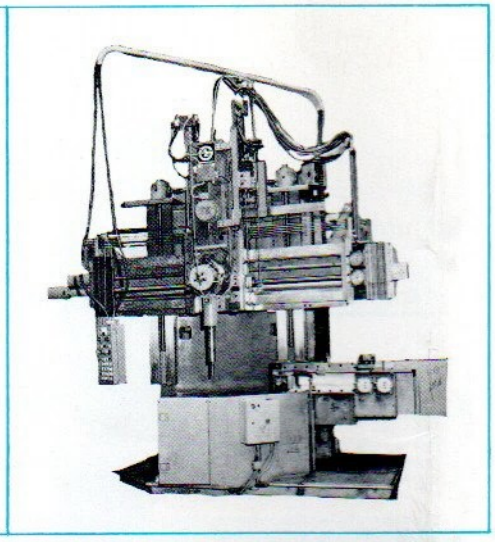
THE SCAN-O-MATIC 270 TRACING SYSTEM



14' GRAY VBM



66" BULLARD DYNATROL VTL



42" GIDDINGS & LEWIS VBM

The Scan-O-Matic Tracer Control System, installed on a vertical turret lathe, provides a whole new range of production possibilities for the machine tool. It is a two-axis, coordinated, fully hydraulic tracing system featuring the ability to turn, face or bore angles, radii, or even opposed 90° square shoulders in a continuous path at a constant feed rate.

The Scan-O-Matic System is so designed that it becomes a permanent part of your machine tool, yet it does not modify or interfere with the normal use of the machine.

The System employs rotary fluid motors and transmissions coupled to the existing feed shafts of the machine for actuating the slides. When it is desired to change from trace to manual operation, it is only a matter of disengaging the electric clutches on each of the fluid motors.

The high torque, low RPM, custom-designed Scan-O-Matic fluid motors respond to template variations within tenths for fine finishes, yet they are capable of providing ample power for the heaviest roughing cuts.

The unique trace direction control center of the Scan-O-Matic System offers independent feed rate control for each axis. The vari-flo controls are fully adjustable while tracing, which means you can increase or decrease the feed rates of each axis to obtain the best possible machining results and tool wear. In addition, the handy control center features the ability to switch tracing axes from turning to facing to boring by merely pushing a valve spool button.

The heart of the System is a two-axis, fully coordinated hydraulic tracer valve. The model 180 and 270 Valves are of a wafer-type construction, machined and individually hand fit to insure the performance, tolerance and long life required in tracing equipment. This patented instrument features an automatic balancing device which is designed to control the relationship between the lead and contour axis. With Scan-O-Matic it is not necessary to manually balance or "trim" the System when you want to go from roughing to finishing or turning straight walls on opposed square shoulders - it is all done automatically in the valve.

Other features of the valve include a free floating, constantly oscillating valve spool which insures stylus sensitivity and repetitive accuracy, adjustable stylus pressure, automatic disconnect on over-deflection, and a manual retract mechanism for operator convenience and protection.

The tracer valve is supported by a valve positioning compound and swivel arm. The valve positioning compound slide is a highly accurate instrument with adjustable gibs for positive fit. The compound contains two micrometer dials and accurate micrometer screws which allow 2" adjustable movement along each axis of the compound. The valve swivel arm portion of the instrument provides complete mobility for the basic positioning of the tracer head.

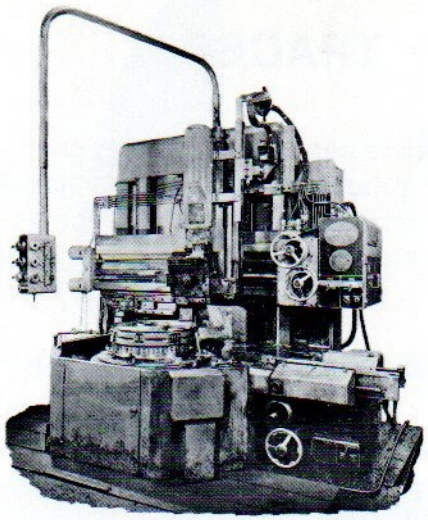
The Scan-O-Matic template rail supplied with each System is constructed of heavy steel stock, machined and ground to very close tolerances. It has an accurately milled straight edge cut into the face of the rail for square positioning of the template to the rail. A template rail vertical extension is provided with the System for additional template support. The template rail mounting brackets are of a heavy welded construction and provide template rail support for the full travel of the machine, large or small.

The Scan-O-Matic System also includes a hydraulic power unit. This Power Pac is highly efficient and of compact design, requiring only 13" × 25" floor space. It has a 10 gallon capacity and a 6 GPM variable volume pump driven by a 1-1/2HP electric motor. The Power Pac is complete with neccessary sight gauges, vacuum unit, filter cap with air filter, cooling unit, and a covered top which opens for easy cleaning when required. Extra filtration is provided by a throw-away 10-micron filter.

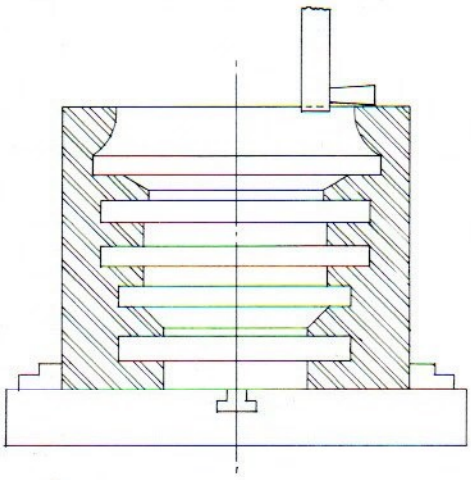
Scan-O-Matic is a complete hydraulic tracing system designed to fit your machine, and will insure repetitive accuracy and dependable performance at the lowest possible cost.

SCAN-O-MATIC PROVIDES COMPLETE FIELD INSTALLATION ON YOUR MACHINE.

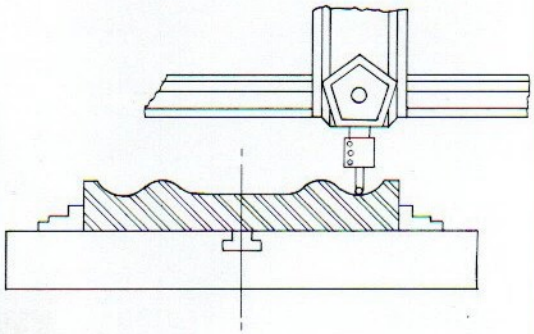
2 AXIS CONTINUOUS PATH HYDRAULIC TRACING



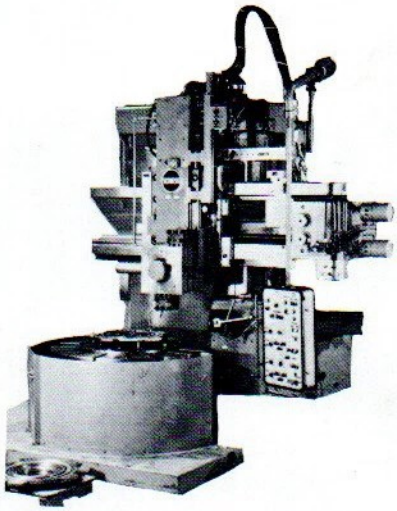
46" BULLARD



OPPOSED SHOULDER BORING



CONTOUR FACING



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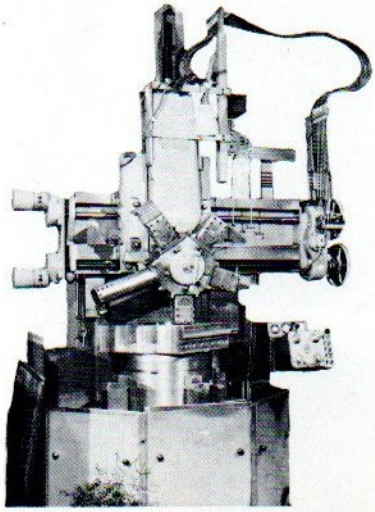
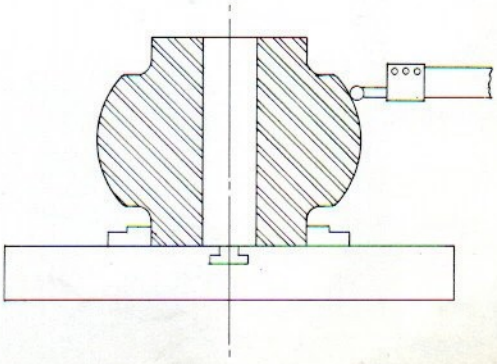


WEBSTER & BENNETT



OD TURNING

SCAN-O-MATIC®

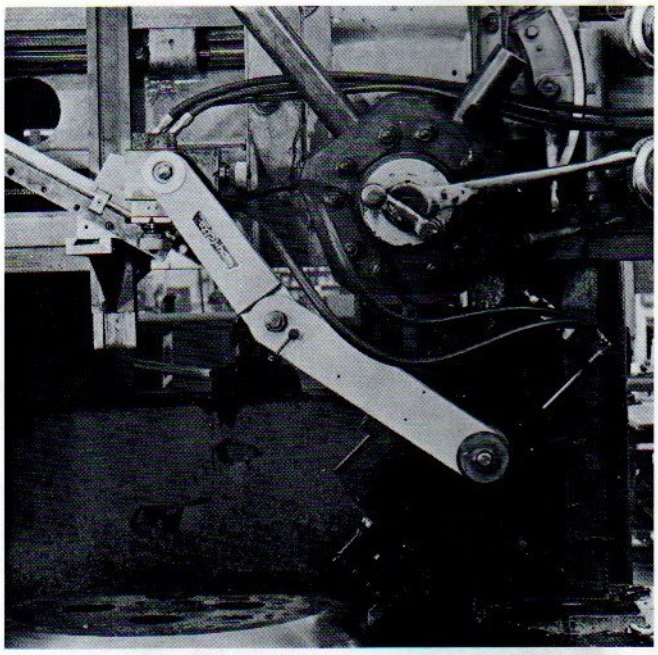
Copy-Rite® TRACER

Increase your machine capacity when you change your vertical turret lathe into a high production machine. COPY-RITE eliminates the need for out-dated machining methods, such as expensive form tools that must be changed with each operation. A single point tool is all that is required.

Copy-Rite® DESIGN ADVANCES MEAN HIGHEST PERFORMANCE TROUBLE FREE TRACER LIFE

A heavy duty member of the CR family, designed for use with Vertical Turret Lathes and Vertical Boring Mills. The CRV-9 can be readily adapted to the Ram, Turret or Sidehead.

STANDARD CRV MODEL



CRV SERIES MOUNTED ON A VERTICAL TURRET LATHE

- **Two-piece 360° double pivoting valve arm** allows greater flexibility when making tracer setups - reducing time as much as 50%. (Standard on all CRV Models.)
- **Master Control Center.** Unique in tracer manufacturing. Four new controls to boost operator efficiency. Three-position selective control lever incorporates "rapid traverse," "preset infeed," "positive stop." It also features variable infeed rate control and reversing tracing control.
- **Two-Axis Valve Slide Assembly** with spring loaded gibs and accured accuracy in "tenths." Hand-sized dials in .0005" increments.
- **Hydraulic Servo Valve.** Totally new design of "rise and fall" groove-configuration with hardened spool and sleeve. Valve can be serviced in the field.
- **Totally-Enclosed Cylinder Assembly.** Totally enclosed and protected cylinder assembly is fitted with self aligning piston rod, rod wipers and teflon slipper seals on piston for low friction and long life.
- **Automatic Lubrication System.** Automatic way lubrication provides constant film of oil to tracer ways. Sight glasses show oil level in reservoirs.

SCAN-O-MATIC HYDRAULIC TRACER SYSTEMS

SCAN-O-MATIC® INC., 5100 - 21st Street RACINE, WISCONSIN 53406

VTL600-6/80/10M

SCAN-O-MATIC, INC.
5100 - 21st Street
Racine, Wisconsin 53406 USA
(414) 554-6811

SCAN-O-MATIC, INC. COMPONENT WARRANTY

A. Scan-O-Matic, Inc. warrants all components to be free from defect in material and workmanship. All Scan-O-Matic, Inc. and Copy-Rite components sold are covered by such warranty for a period of twelve (12) months from date of shipment. Any components requiring service during this twelve (12) month period are to be returned to Scan-O-Matic, Inc. for repair or replacement at no charge. (Freight to be paid both ways by Customer.) This warranty is limited to repair or replacement of the defective components and specifically disclaims liability for any other damages, costs, expenses incidental or consequential damages.

B. Damage due to carelessness of Customer personnel will not be covered by this warranty. Determination of damage to be by authorized Scan-O-Matic Inspector only.

C. Warranty claims will not be accepted unless complete details covering full name and address of Customer, date of sale, model, and serial number of product sold is filed with Scan-O-Matic, Inc. This information is to be listed on the Dealer's/Customer's purchase order to Scan-O-Matic, Inc.

2/2/96 Hans Christian

DIRECTIONS FOR OPERATING THE SCAN-O-MATIC TRACING SYSTEM

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GENERAL DESCRIPTION

The Scan-O-Matic Two-Axis Hydraulic Tracer Control System, when installed on a vertical turret lathe or boring mill, provides a whole new range of productive possibilities for the machine tool. Contour turning with the Scan-O-Matic system is as readily accomplished. To assist you in considering this system to its fullest degree, the following pages have been prepared. They will include explanations of the various components as well as basic set-up diagrams.

Pages 2,3,4&6 are diagrams which explain the flow control and direction control mechanism of the system. Installed on your VTL will be our Model 270 system. The controls for the operation are explained.

The Scan-O-Matic System is so engineered and designed that it becomes a permanent part of the machine, yet it does not modify or interfere with the normal use of the machine. The system employs rotary fluid motors coupled to the existing feed shafts on the machine or actuating the slides. When it is desired to change from tracer control to normal machine operation, it is only a matter of disengaging a pair of electric clutches located on each of the Scan-O-Matic fluid motors.

You will find an accurate description on pages 7 through 11 of this booklet of the stylus, tool relationship. On these pages is explained what takes place when the stylus follows a template and how the system compensates for stylus deflection to insure your repetitive part to template accuracy.

A feature of Scan-O-Matic is the ability to turn or face, bore, angles, radii, or opposed 90° square shoulders in a continuous path at a constant feed rate. An example diagram of the operation is contained in the booklet on page 10. Reviewing this diagram will help you set up those difficult tracing operations.

Pages 12 and 13 are devoted to the problem of evaluating your machine project and preparing a stylus to fit this project. The examples cited for this explanation are the machining of square walls on opposed shoulders.

The use of this manual should provide the answers to most of your minor questions. Keep this manual handy for quick reference.

MODEL 270 TRACE DIRECTION CONTROL VALVE
WITH VARI-FLO FEED RATE VALVES

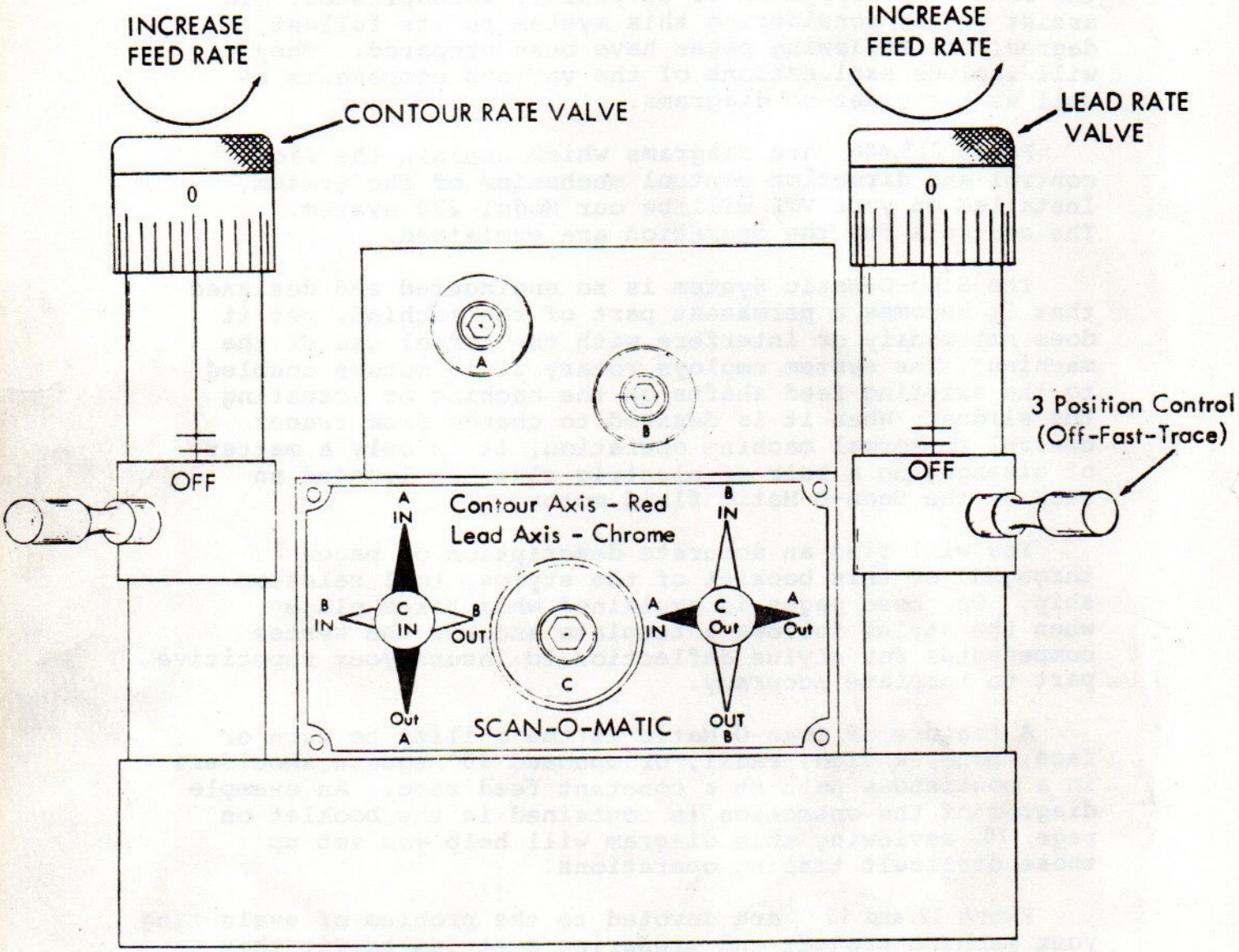
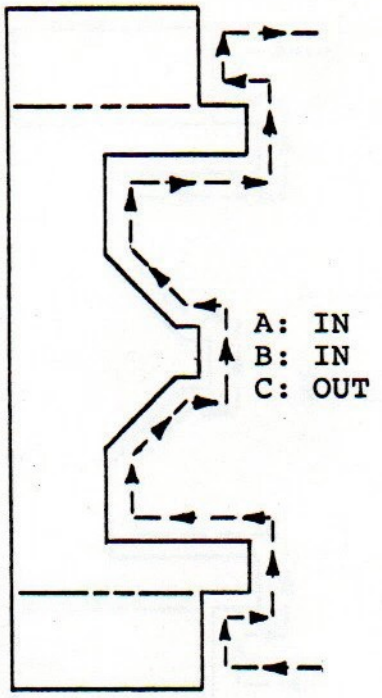


Figure 1

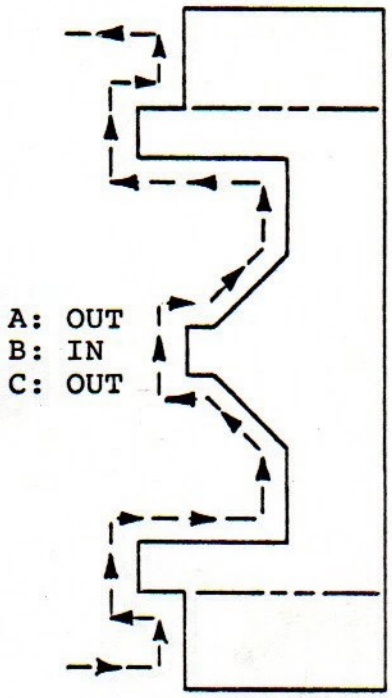
KNOB (C) IS FOR SELECTION OF CONTOUR (TRACE) AXIS.
KNOB (B) CONTROLS THE DIRECTION OF FEED.
KNOB (A) CONTROLS THE DIRECTION OF SEEK OF THE STYLUS ON THE CONTOUR AXIS.

NOTE: INSTRUCTION PLATE POINTERS SHOWS DIRECTION OF SLIDE TRAVEL FOR EACH COMBINATION OF A-B-C SELECTIONS.

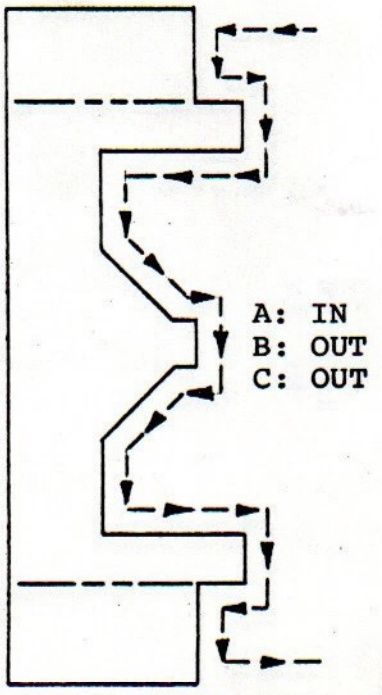
RIGHT RAM O.D.
LEFT RAM I.D.



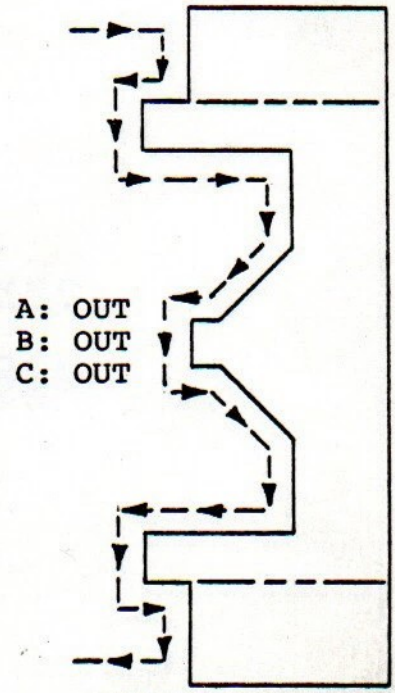
RIGHT RAM I.D.
LEFT RAM O.D.



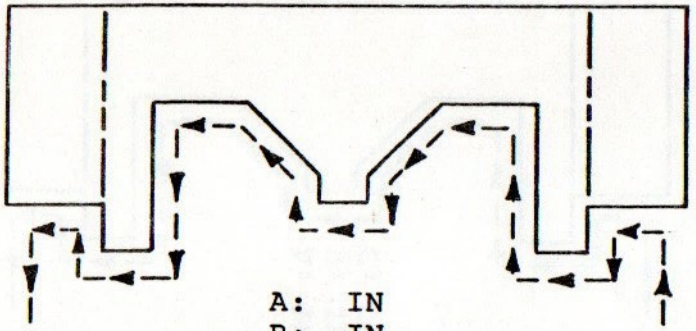
V.T.L./V.B.M. WITH #1425
TRACE DIRECTION CONTROL
O.D. & I.D. CONTOURING



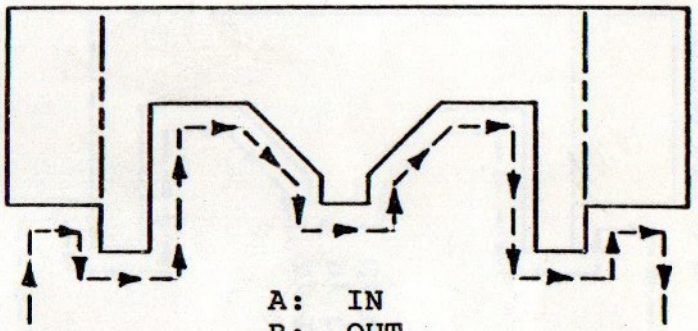
RIGHT RAM O.D.
LEFT RAM I.D.



RIGHT RAM I.D.
LEFT RAM O.D.



A: IN
B: IN
C: IN



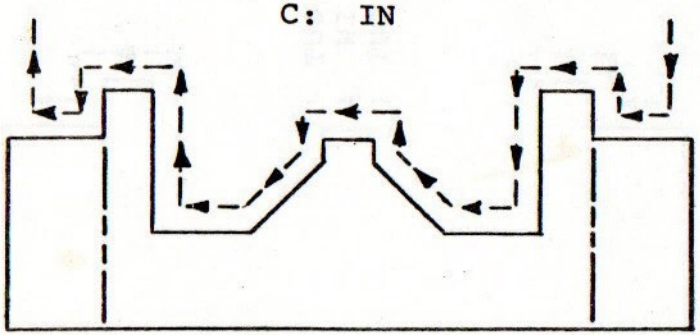
A: IN
B: OUT
C: IN

V.T.L./V.B.M. #1425

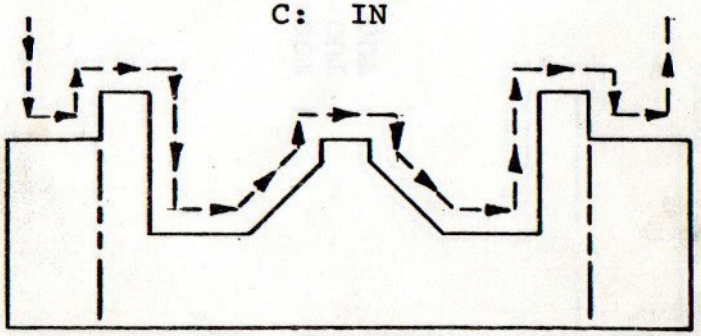
TRACE DIRECTION CONTROL

FACE & BACK FACE CONTOURING

A: OUT
B: IN
C: IN



A: OUT
B: OUT
C: IN



270 TRACE DIRECTION CONTROL WITH VARI-FLO VALVING

The 270 trace direction control with Vari-flo valving is the component that directs the flow of oil in the desired amounts and in the desired direction through the system. The components can best be described in two parts; one, the trace direction control valve, and two, the Vari-flo feed rate valves.

The trace direction control valve in the Model 270 system contains three push/pull spool valves that regulate the selection of axis and the direction of trace desired. The larger lower valve (C) (See page 6) is for selecting the axis to be used for contouring (or seek). The small upper knob (A) on the left hand side is for the direction of contour (or seek) of the stylus. The small spool valve (B) on the right reverses the lead feed. A tag which describes the functions of the three spools is conveniently located on the front of the valve block.

The Vari-flo valves are used to regulate the flow of oil in the desired amounts to each of the motors in the system. The Scan-O-Matic system provides the operator with independent feed rate control for each axis. The graduated dials on the valves are infinitely variable and fully adjustable while tracing, giving two-axis coordinated constant feed rate or a reduced or increased feed rate on one axis in relation to the other as required for best machining results.

A full flow lever is provided on each valve which permits higher speed movement of the tracer in both axis. This movement can be accomplished without disturbing the setting on the graduated feed rate dial setting. This rapid advance lever can also be moved to a closed position to quickly shut off the valve without disturbing the dial setting.

CONTROLS

Fig. 1 is a drawing of the control assembly. The levers and valve spools may be operated in any manner without damage to the system, but it is always advisable to dry run a template before starting to cut to insure that the right combination has been selected. (See Fig. 2 and 3 for valve settings.)

The graduations on the Vari-flo rate dials are for reference only. The feed rate for each slide can be adjusted individually while cutting, without disrupting the rate set for the other slide. When the best setting for each axis has been selected, the three position levers can be used for shutoff, full flow, and back into trace again with further re-setting of the dials.

The dials on the tracer valve positioning slide are graduated in thousandths. Each thousandth on the dial represents two thousandths on a turned diameter.

DIRECTIONAL CHART WITH VALVE C IN:

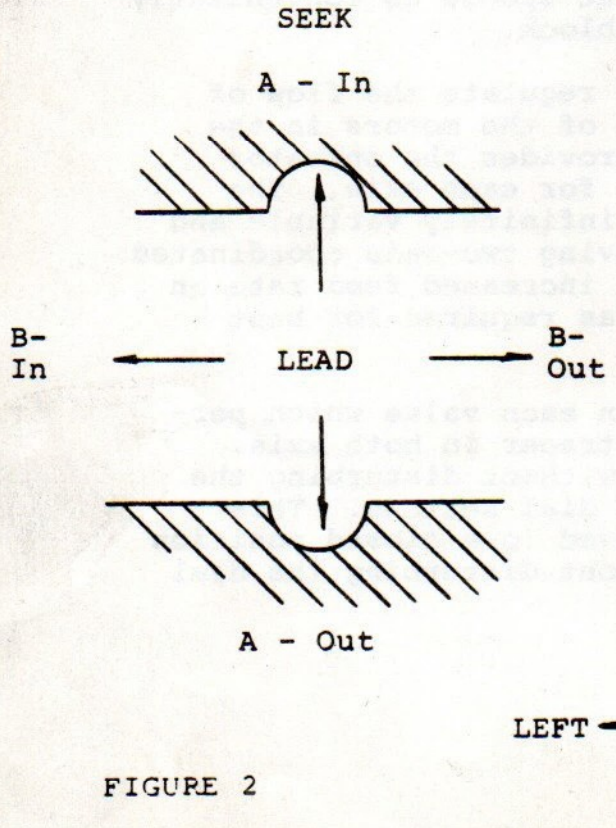


FIGURE 2

DIRECTIONAL CHART WITH VALVE C OUT:

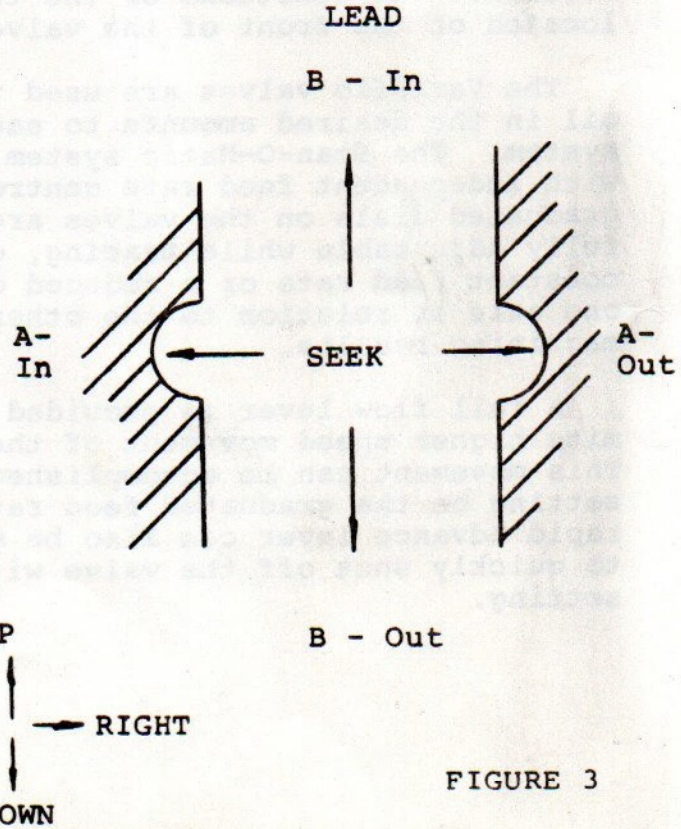
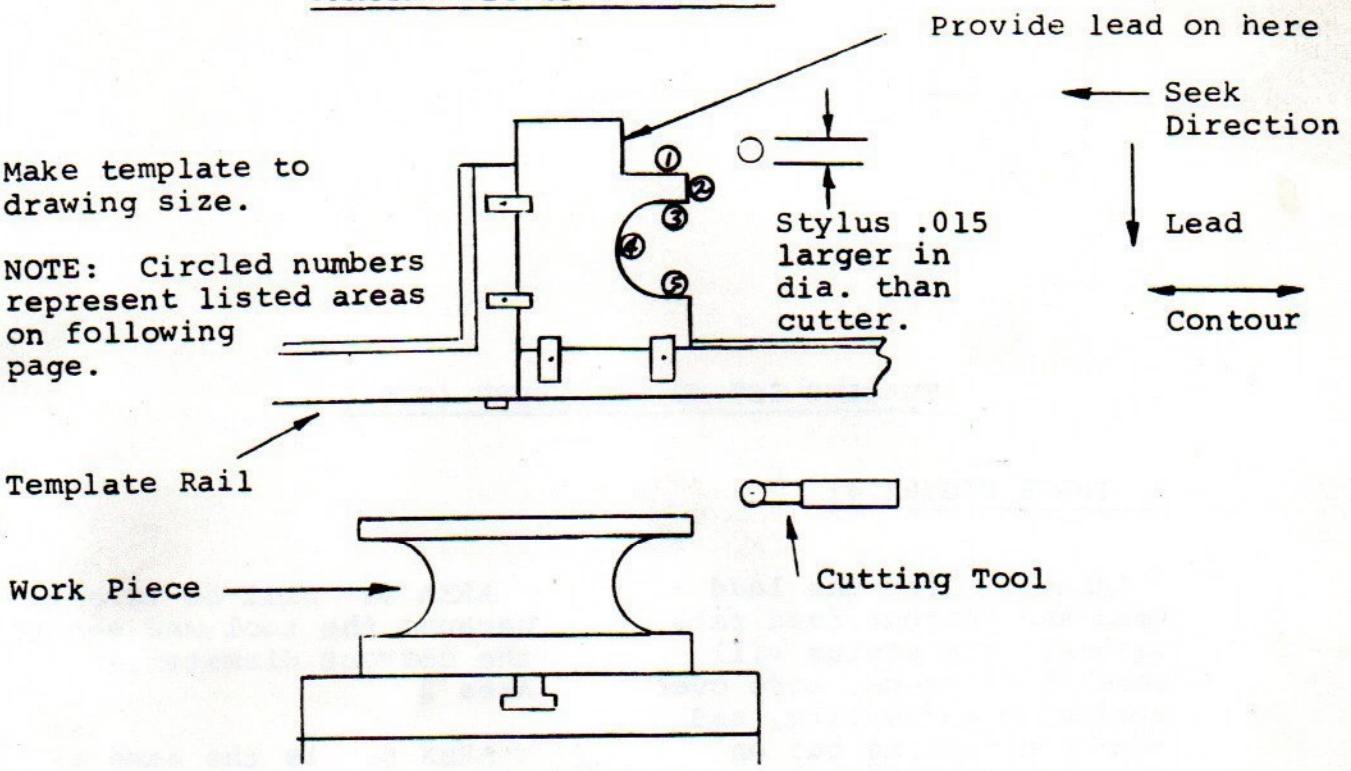


FIGURE 3

TRACING SET-UP Procedure



The above sketch shows a job being set up for tracing. When roughly lining up the tool and stylus, make sure that the stylus is ahead of the cutter along both axis so as not to cut into the work when the stylus contacts the master.

<u>To adjust tool position in relation to the template along the contour trace mode</u>

Open the contour trace flow rate valve and let the stylus seek the template. Then, with the stylus riding the template and the contour flow rate valve still open, adjust on the valve positioning compound slide and the machine slide will follow in either direction. Adjust until the tool touches the work.

<u>To adjust the tool position in relation to the template along the feed axis:</u>

This is more difficult because the feed is in one direction only. Also, because the tracer will not seek along the feed axis, it becomes necessary to provide a lead-on on the template to seek against. This lead-on can be built on to the template, or it can be a loose piece held or clamped to the template temporarily, for the tracer to seek against. When the stylus is against the shoulder (Area 1, Fig. 4) and commences to move along the axis, close the contour flow rate valve and with the lead flow rate valve still open, back off the tracer valve positioning compound slide slowly until the tool touches the shoulder.

If the cutting tool is inadvertently advanced too deep into the work and must be brought back, then, because the lead feed cannot reverse it becomes necessary to use the rapid traverse feed to move the ram head back. When the stylus is away from the template, advance the valve positioning slide and repeat the above procedure.

TRACING SET-UP PROCEDURE (CONT)

TO TRACE FIGURE 4:

AREA 1. Open the lead feed and contour feed rate valves. The stylus will seek the lead-on, move over against the template, and commence feeding out on Area 1. At this point, the stylus is deflected .015 and to compensate for this deflection, the stylus must be made .015 larger in dia. than the cutter to achieve correct size on the oposed wall.

AREA 2. Let the stylus trace around the corner and on to Area 2. There is a .007 deflection here and this is compensated for by adjusting the cross slide on the valve positioning compound to obtain the correct diameter on the work.

AREA 3. Tracing further, when the stylus gets past the inside corner on Area 2, it straightens out and with zero deflection, will trace the inside wall of the shoulder straight and to size.

AREA 4. Will be to size because the tool was set to the correct diameter at Area 2.

AREA 5. Is the same as Area 1 and will be accurate.

From the foregoing, it will be seen that the relationship between the cutter and stylus always remains the same, regardless of the shape of the template. If the angles vary, the stylus deflection will vary accordingly, and the result is true template to part accuracy.

NOTE OF CAUTION: The above directions are for tracing in one direction only. If it is desired to finish an opposed shoulder or wall by reversing the feed to feed against the wall, then the stylus must be made .030 larger than the cutter.

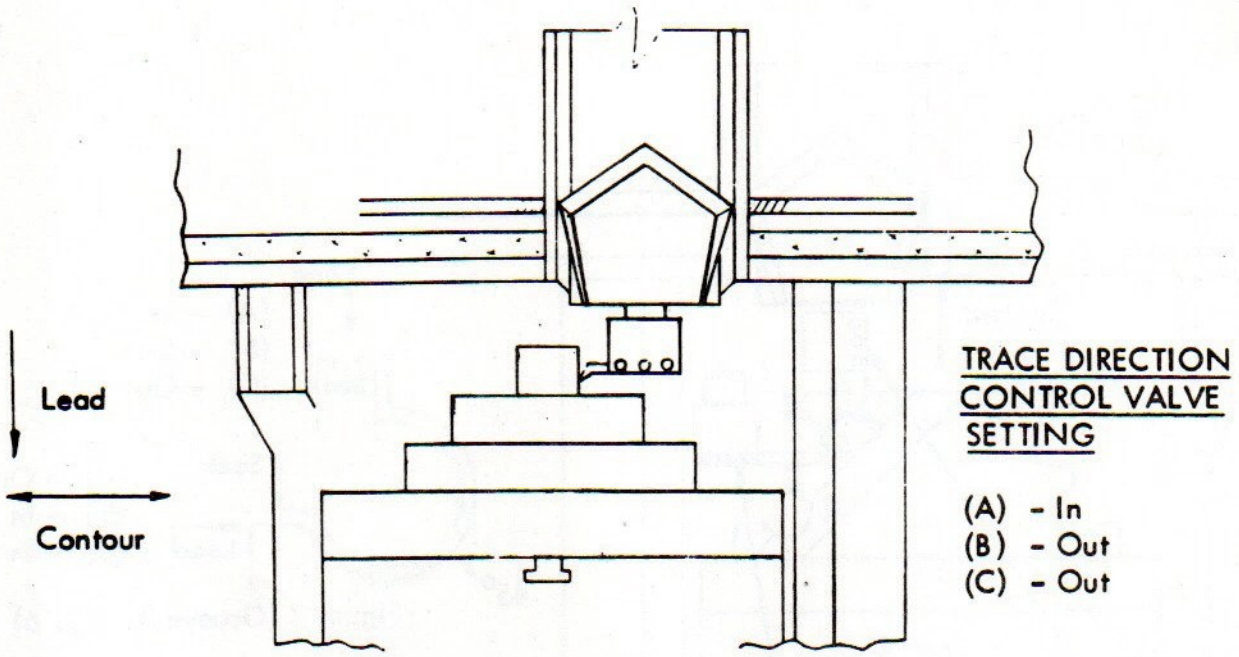


Figure 5

TO TRACE FIGURE 5:

The above figure illustrates a part to be tracer machined. Set the work up in the usual manner and clamp the template to the template rail in an approximate position to the workpiece.

As explained earlier in this manual, one slide is a coordinated feed in one direction only, while the other slide operates back and forth to generate the contour. To determine which slide is to be selected for contouring, study the shape of the part to be machined. (See Fig. 5 and 6).

For instance, on a shape like Figure 5, it would be a matter of preference whether to use the vertical slide or the horizontal slide for the contouring, whereas from the form shown at 1 on Figure 6, only the vertical slide can be used.

To position the stylus correctly in relation to groove 1, Figure 6, provide a lead-on on the side of the template to seek against. Position to where the cutter touches the finished wall of the workpiece as explained under "set-up" area, page 7.

NOTE OF WARNING: It might appear to be more convenient to seek against the side wall section of the template for positioning and then change the trace mode before tracing the top. However, if this procedure is followed, the positioning becomes incorrect because the stylus deflection changes with the direction of trace. (See "SET-UP", pages 6 and 7.)

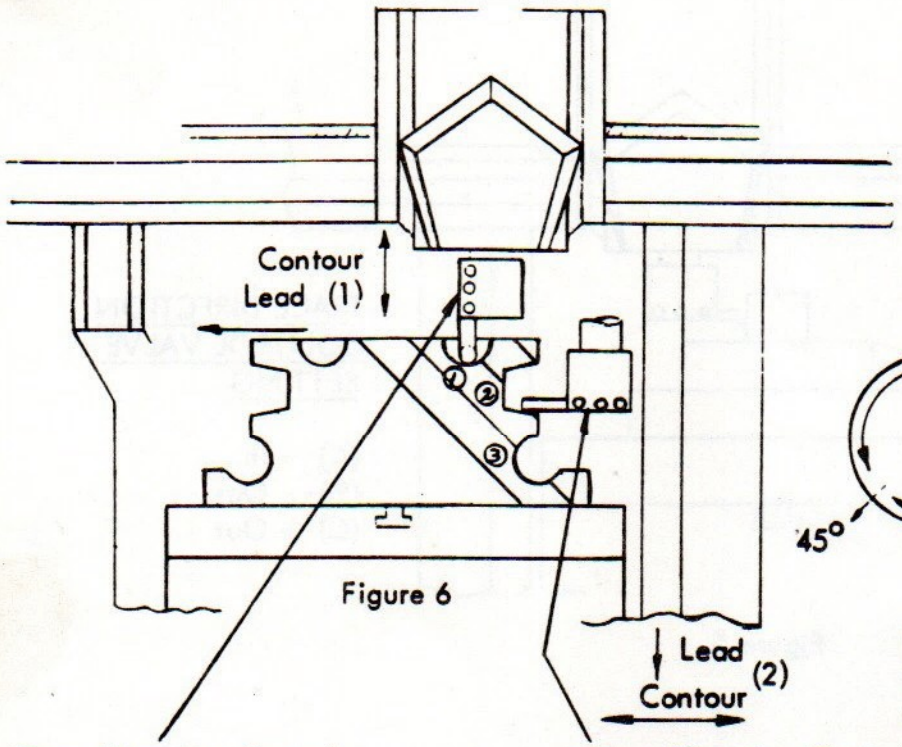


Figure 6

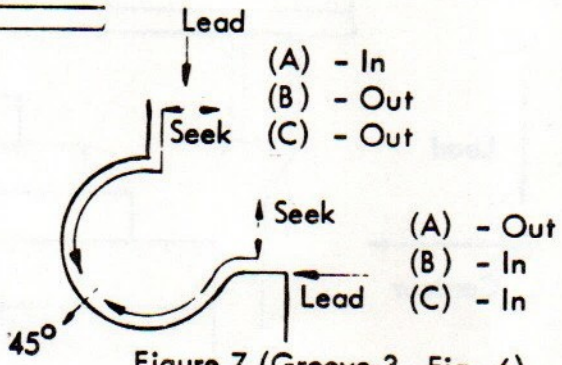


Figure 7 (Groove 3, Fig. 6)

Retract cutter at 45°, change trace mode and cut from other direction to blend in point.

Trace Direction Control Valve Setting:
(A) - Out
(B) - In
(C) - In

Trace Direction Control Valve Setting:
(A) - In
(B) - Out
(C) - Out

For groove 2, Fig. 6, it will be seen, by referring to the Fig. 3 illustration that the horizontal slide should be used for contouring.

For groove 3, Fig. 6, the illustration (Fig. 7) shows that this groove cannot be traced within the contour range of either slide.

However, aside from tooling, which is always a problem on this type of operation, this contour can be traced by shifting the contour mode from one axis to the other. The shift can be made while cutting, thus making the cut continuous, but because of the difference in stylus deflection, this will leave a slight step in the cut where the shift is made.

If this step must be avoided, follow the procedure as shown on Figure 7.

By selecting the trace mode as shown, and feeding in direction of the arrows, the stylus deflection will be equal at blend-in point, resulting in a smooth cut.

TEMPLATE AND STYLUS

The Scan-O-Matic tracer spindle action is universal, so the valve need not be set square with the template. The deflection, that is the side motion of the stylus required to move the valve spool through its complete cycle, is approximately .014 -.016 when the stylus contacts the template 1-1/2" from the tracer spindle nose.

Make a test sample to determine the exact amount of valve deflection on a new installation. For template, use a piece of 1/8" x 1", ground flat stock with parallel edges and strap it on the template rail. Have it protrude about 3/4" beyond the edge of the vertical template rail and line up the sides parallel with the horizontal cross rail of the VTL.

Chuck a piece of stock in the VTL and turn a flange on the stock to correspond with the width of the template. Seek the vertical template rail horizontally and feed down around the template.

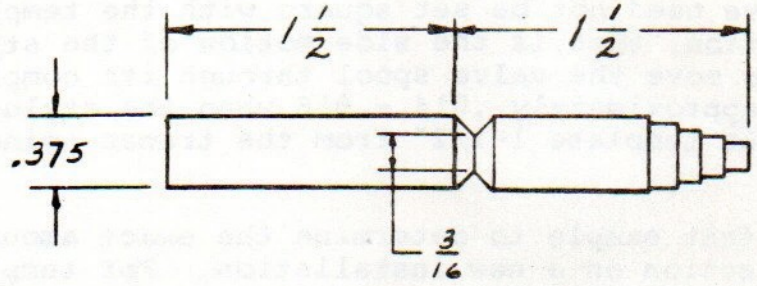
For roughing, use a stylus .030 wider than the tool. Then with a stylus the same width as the tool, finish the side walls of the flange (see page 7). Measure the width of the finished flange and subtract this dimension from the width of the template. The difference is the amount the stylus should be wider than the tool when cutting in one direction only.

To determine total stylus deflection for cutting in both directions, reverse the lead feed and trace back over the flange. Feeding against the back side of the flange in this manner makes the stylus deflect when contacting the wall and because there was no stylus deflection coming down on the wall feeding from the front side, this then results in a new cut.

The difference in this width of the finished flange, subtracted from the width of the template, is the amount the stylus should be wider than the tool (approximately .030) when cutting from both sides and with the stylus contacting the template 1-1/2" from the tracer spindle hose).

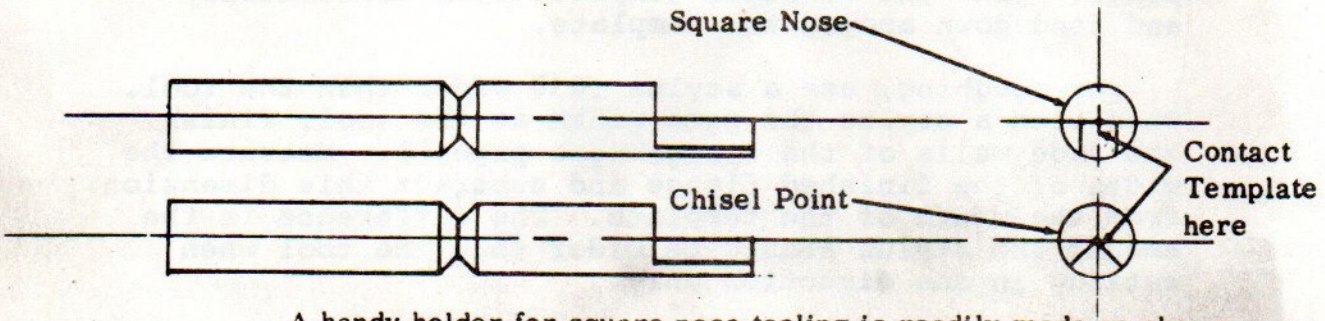
To avoid damage to the tracer valve in case of mishap, have all stylii necked down to about 3/16" dia. as shown.

GENERAL PURPOSE STEP STYLUS

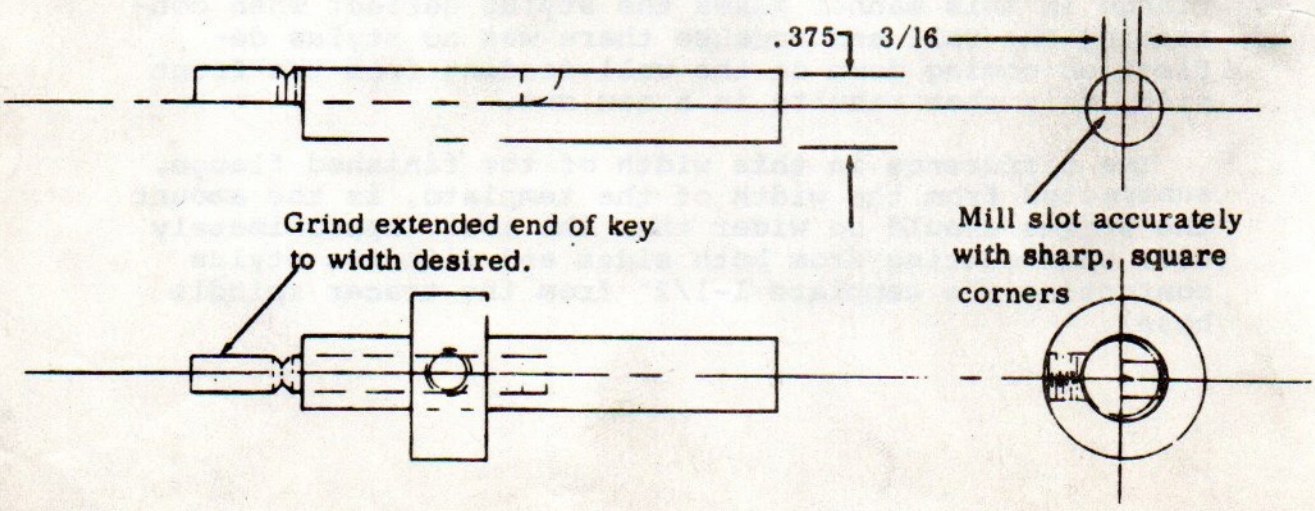


A stylus with a simple taper is also useful. This stylus is adjusted to extend as required on the taper and provides an infinite adjustment for sizing.

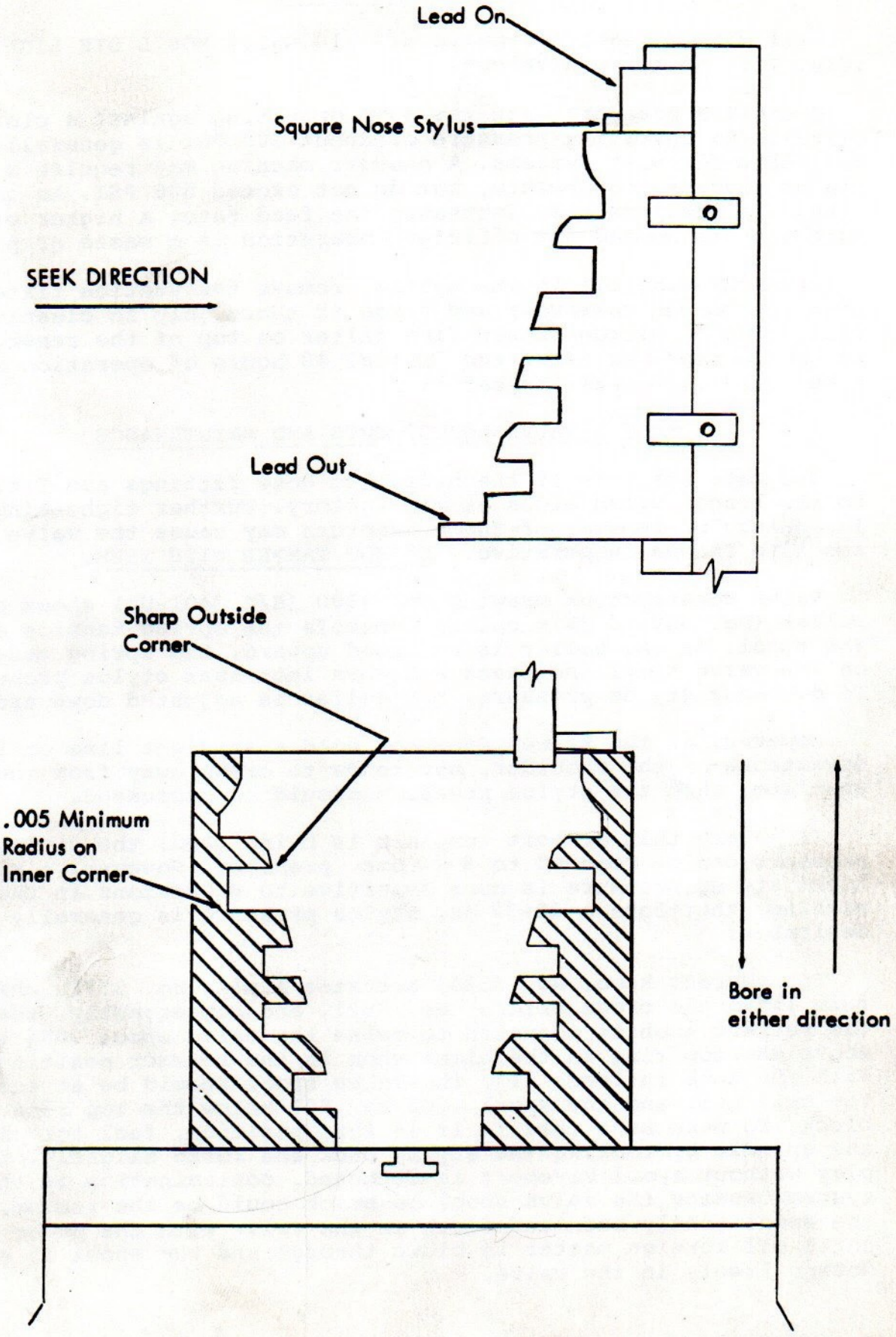
Square Nose and Chisel point stylii should be made offset toward center as shown.



A handy holder for square nose tooling is readily made as shown below. With this holder, it is not necessary to reindicate the tip for squareness to template each time a tip is changed, and the tips are easy to grind.



BORING & GROOVING



HYDRAULIC POWER PAK

Fill with a light hydraulic oil (10 Gal.) MOBIL DTE LIGHT (Vis. 150) or its equivalent.

Check the pressure with the pump operating against a closed circuit. An operating pressure of about 300 PSI is generally desirable for most systems. A heavier machine may require a higher pressure to operate, but do not exceed 500 PSI. An increase in pressure also increases the feed rate. A higher pressure than is needed for efficient operation is a waste of power.

When changing oil in the system, remove the suction filter from inside the reservoir and rinse it thoroughly in cleaning fluid. The 10 micron return line filter on top of the reservoir should be replaced after the initial 40 hours of operation and then every 1-2 months thereafter.

TRACER VALVE ADJUSTMENTS AND MAINTENANCE

The male adaptors of the hydraulic hose fittings are fitted to the tracer valve block at the factory. Further tightening, loosening, or removal of these adaptors may cause the valve spool to become inoperative. DO NOT TAMPER WITH THEM.

Valve construction Drawing No. 3500 (S/N 2401-Up) shows stop collar,(No. 3584). This collar controls the spring tension against the spool. As the collar is adjusted upward, the spring tension on the valve spool increases and thus increases stylus pressure. To decrease stylus pressure, the collar is adjusted downward.

However, if the tracer does not hold a straight line on the downstroke of the shoulder, but tends to creep away from the template, then the stylus pressure should be increased.

If a very thin or soft template is being used, the stylus pressure can be reduced to 8-16 ozs. pressure. However, a very light stylus pressure is more sensitive to vibrations in the machine, therefore a 20-32 oz. stylus pressure is generally desirable.

The retract knob, No. 3525, actuates a pin, No. 3522, which in turn lifts the cross bridge, No. 3521, and consequently, the spool. The retract knob is adjusted to raise the valve spool .006 to .007 above the top ring in the block when in the retract position "R". With the knob in trace "T", the valve spool should be at rest in the ball nest and the spool .006 to .007 below the top ring in the block. To make sure that it is in this position, feel for play in the spindle by rocking the stylus back and forth slightly. If any play without spool movement is detected, contamination in the system causing the valve spool to stick could be the reason. Work the spool gently back and forth in the valve with the power on until all foreign matter is blown through and the spool is again moving freely in the valve.

TRACER VALVE ADJUSTMENT AND MAINTENANCE (CONT)

Tracer valves used on Model 270 systems have a safety limit switch mounted on an adjustable bracket. This bracket is adjusted so that the limit switch is actuated if the stylus is deflected .002 to .005 beyond the normal retract position. This limit switch activates a solenoid-operated two-way valve on the power pak which stops all oil flow to the system.

110 VOLT OSCILLATOR MOTOR MAINTENANCE

Saturate the felt pads on the oscillator motor with a good grade of light oil. Lubrication: use premium grade SME 20 or 30 oil at 2 to 6 month intervals, depending on frequency of use.

FLUID MOTORS

The Scan-O-Matic fluid motors are very simple in design, but due to the exacting requirements of tracing, have to be held to extremely close tolerances.

It is therefore imperative that extra caution be taken if, for any reason, it becomes necessary to disassemble one.

On new installations, small pieces of rubber or foreign matter sometimes get into the system ahead of the filter, which could cause a fluid motor to stall. This could be caused by foreign matter getting wedged along side one of the vanes, and it sometimes can be corrected without removing the motor from the machine. Remove one of the spring caps, No. 1108, and spring, and with the blade of a small screw driver, held against the back of the vane, rotate the rotor back and forth by hand, working the vane up and down over the cam until it is completely free. Replace the spring and cap and repeat the operation on the other vanes.

If it is not possible to free the vane in this manner, it will be necessary to disassemble the motor to check the vanes and slots for burrs and chips.

First, remove the end caps and the four spring caps, No. 1108, and springs. Looking at the end of the motor, in the recessed part on one end are four 1/4-20 threaded construction holes on 4-15/32 dia. bolt circle. Set the motor on the bench with these holes down and turn the rotor a full turn or more. This will push the four vanes back in the block and the rotor should pull out without interference. The rotor is tapered and cannot slide out the end. DO NOT FORCE THE ROTOR.

After clearing the vane slots thoroughly, replace the vanes making sure that each vane slides perfectly free in its slot. The two edges on one end of the vane have been honed slightly. The vanes are installed with this end toward the construction holes in the block.

Be careful not to fold over the sealing edges of the seals when replacing the end caps. Oil the seals and the seal hub on the rotor and gently make the seals slide over the hub taper onto the hub, using a back and forth rotary movement.

MODEL 270 TRACER VALVE

The tracer valve and tracer valve block are of a wafer type construction, machined and individually hand fit to exacting tolerances. These close tolerances guarantee definite positioning of the oil ports which control the flow of oil to the motors in the precise amounts required to obtain exact duplication of the template.

The spool itself is designed in two parts -- half of the spool controls the lead movement of the system and the other half of the spool controls the contour movement. The coordinated movement of these two axis permit uninterrupted 180° continuous path tracing.

Another very special feature built into the tracer valve is an automatic balancing feature designed to completely control the relationship between the lead axis and the contour axis. When required to machine 90° opposed shoulders, the balancing feature will automatically hold the motion of one motor in complete suspension absolutely free from any creep or drift, thereby enabling the system to machine straight walls on opposed square shoulders.

The Scan-O-Matic valve spool is a free floating valve spool which is constantly oscillated by a small electric motor located on the tracer head. This oscillation is important to the tracer systems as it provides life to the spool to respond to every movement of the stylus. With constant stylus sensitivity, repetitive accuracy is assured.

Important plus features contained in the Scan-O-Matic valve are fully adjustable stylus pressure from 8-32 oz. This permits the usage of templates made of various types of materials without fear of marring the template.

A safety feature built into the tracer system provides an automatic disconnect of hydraulic power in the event there is over-deflection of the stylus, thereby preventing accidental damage to the template or tracer valve.

MODEL 270 TRACER VALVE (CONT)

A manual retract mechanism is provided for the operator's convenience in the event that a miscalculation during or before machining takes place.

GEAR TRANSMISSIONS AND ELECTRIC CLUTCHES

The gear transmissions used on VTL and VBM installations are grease-packed and have sealed bearings, or they are left open to the machine feed bracket, with the oil from the feed bracket fitting the Scan-O-Matic gear transmissions. In either case, there is no attention required.

To disassemble the transmission: Remove the electric clutch cover, #1216. Loosen the 5/16 set screw in driving hub, #1215, and pull the driving hub with the clutch driving cup off the drive shaft.

The electric clutch is a slip fit on its hub and will slide off, or pry lightly if required.

Remove the three 5/16 cap screws from the motor mounting plate, and the woodruff key from the drive shaft and pull the motor off over the drive shaft.

See "FLUID MOTORS" for instructions on disassembling the motor.

The voltage to the electric clutches is controlled with DC power supply located in the electric control panel. The potentiometer should be set high enough for the clutch to pull the load without slipping. On most installations, a reading of 70 to 80 on the dial is required.

TROUBLE SHOOTING THE SCAN-O-MATIC SYSTEM

PROBLEM: TRACER WILL NOT OPERATE

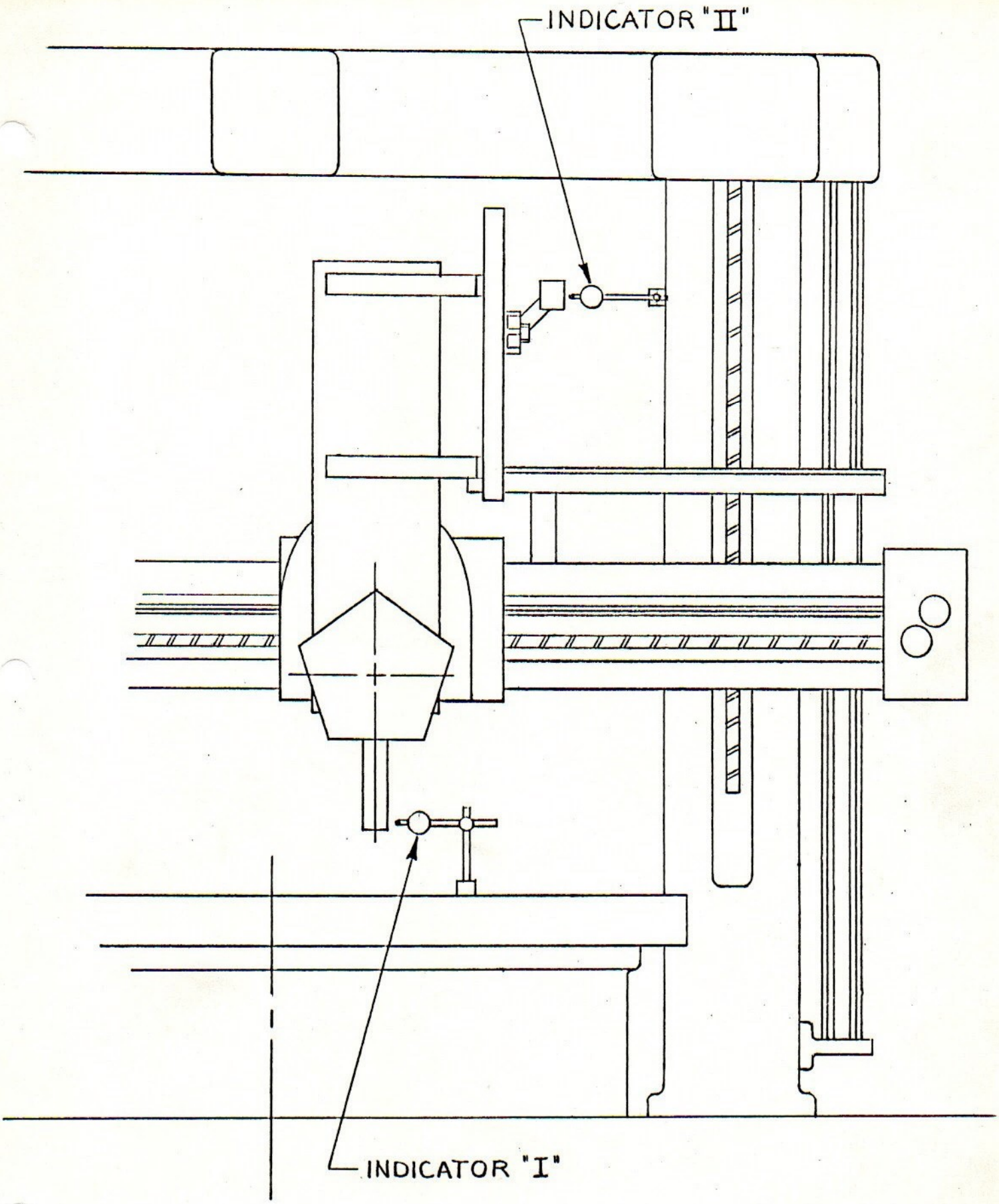
PROBABLE CAUSE	PROBABLE REMEDY
1. Heaters in Nema size "0" starter are tripped.	1. Must be reset
2. Safety stop valve solenoid is energized.	2. Safety stop valve limit switch located in tracer head is in its closed position due to the stylus being over-deflected. Back stylus away from template manually.
3. Safety stop valve spool is obstructed and is held in is closed position.	3. The spool must be removed and cleaned to allow it to move freely.
4. Bind in lead screw of vertical feed shaft	4. Check freedom of feed shaft or longitudinal screw with fluid motor disengaged.
5. Fluid motor has one or more of its vanes obstructed and held in its open position.	5. The fluid motor vanes must be freed up according to the Service Manual.

PROBLEM: WILL NOT HOLD SIZE

1. Template not made correctly	1. Check template and pay attention to small details.
2. Wrong size stylus for the tool being used	2. Stylus must be .015 over-sized if tracing in one direction and .030 over-sized if tracing in both directions.
3. Tool not ground correctly.	3. If radius tools are used, care must be taken when grinding the tool to assure a uniform radius.
4. Sticky tracer valve	4. Check the movement of the valve spool by actuating the stylus manually. Valve may have to be returned to factory for repair.

TO CHECK FISHTAILING OF SADDLE ON A VERTICAL TURRET LATHE AND BORING MILL.

The following procedure is used to check the main saddle gib for looseness or wear. (You will need two (2) Dial Indicators with magnetic bases.) Refer to illustration (page 19-B), and place one magnetic base indicator on the table with the indicator stylus on the tool. Place the other magnetic base indicator on template rail or machine column with indicator stylus on the tracer valve block (see sketch backside). With the hand wheel,manually move saddle to the right to take up all the backlash in the screw and nut and then "zero" out the dial indicators. Then with the hand wheel again manually reverse the saddle motion (left) until (through the backlash) both indicators have moved at least .001". Check both dials, one dial indicator will probably have a higher reading and if the differential between both dials exceeds .0015, the main saddle gib needs to be adjusted or removed and rescraped to eliminate high spot causing the saddle rock.


INDICATOR "II"
INDICATOR "I"

TROUBLE SHOOTING THE SCAN-O-MATIC SYSTEM (CONT)

PROBLEM: POOR FINISH

PROBABLE CAUSE	PROBABLE REMEDY
1. Dull tool or insufficient tool clearance.	1. Regrind or reset tool properly.
2. Cross rail is worn causing movement or rock of tracer valve.	2. Adjust saddle center properly or if slide is badly worn, rescraping may be necessary to achieve proper bearing.
3. Tracer valve positioner slide is loose allowing excessive movement of tracer head.	3. Adjust the slide gibs and check for loose swivel arm.
4. The flex hoses leading to the tracer valve are imposing a strain on the tracer valve.	4. Rearrange the hoses to allow free movement of the cross slide.
5. Under-powered fluid motor.	5. In some severe torque applications, a larger fluid motor may be required or the existing motor is worn or damaged.
6. Uneven feed.	6. Check for bind in both vertical and horizontal screw and nut assembly.

PROCEDURE FOR REPLACING O-RINGS IN THE SPOOLS OF THE TRACE DIRECTION CONTROL PANEL

1. Loosen Allen Head Cap Screws in the front and rear of the valve spool.
2. Remove washer (rear) and plated knob (front).
3. Push spool to the rear of block until O-Ring is exposed.
4. Remove O-Ring from front groove of trace directional control block.
5. Remove spool by pushing spool from back sides of block through the front of the directional control block.
6. Remove back O-Ring from groove.
7. Clean spool and valve block lapped hole. Be sure to check for burr at front and rear of hole.
8. Check fit by inserting spool without O-Rings. (Spool should move freely).
9. Insert rear O-Rings in valve block groove.
10. Install spool from front and push spool through until front O-Ring groove is exposed.
11. Install front O-Ring in groove.
12. Reposition spool.
13. Replace washer (rear) and knob (front).

NOTE: Reason for procedure is to eliminate possibility of stripping O-Rings with sharp edges on valve spool.